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Research Article

Performance evaluation of Barley (*Hordeum vulgare* L.) genotypes in Dolakha, Nepal: from yielding perspective

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ABSTRACT

Lack of suitable barley varieties that exhibit high yielding is the major factor among several production constraints contributing to low productivity of barley in Nepal. The present study was done to evaluate and recommend the best performing barley genotypes. This study was conducted at research field of Hill Crops Research Program (HCRP), Dolakha, Nepal under National observation nursery (NON), initial evaluation trial (IET), coordinated varietal trials (CVT) and farmer's field trials (FFT) during winter seasons from 2017 to 2018. The results of these trials showed that in NON, genotypes namely B86023-1K2-OK3 (6.16 t/ha), Xveola-28/MATICO"S"10 (4.41 t/ha) and ACC#2079 (4.41 t/ha) produced higher grain yield over Farmer's variety (3.57 t/ha). The pooled analysis over years of IET revealed that genotypes namely LG-51/Xveola-2-77-0-3-1-1-OK (2.12 t/ha) and B86099-2-1-OK (2.06t/ha) produced higher grain yield over standard check variety (Solu Uwa) (1.85 t/ha) and Farmer's variety (1.95 t/ha). Similarly results of combined analysis over years of CVT showed that the genotypes namely B90K-007-0-2-2-0-OK (2.14 t/ha) and ICB90-0196-OAP-2K-OK (1.97 t/ha) produced higher grain yield over standard check variety (Solu Uwa) (1.12 t/ha) and Farmer's variety (1.66 t/ha). In farmer's field trials (FFTs) the genotypes namely Muktinath (Coll#112-14 (2.64 t/ha)), NB-1003-37/903 (2.23 t/ha) and Xveola-45 (2.04 t/ha) produced higher grain yield which was at par to standard check variety (Soluuwa) (1.58 t/ha) and Farmer's variety (1.85 kg/ha). It is suggested that the superior genotypes derived from CFFT could be released and then recommended to farmers for general cultivation in Dolakha and similar other environments of Nepal.

Keywords: Barley, Food security, Grain yield and Genotypes

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INTRODUCTION

Barley (*Hordeun vulgare* L.) belongs to the genus *Hordeun* in the *Triticaceae* of Gramineae family. It is self-pollinated diploid 2n=14. It is fourth important cereal crop after wheat maize and rice in the world (Akar *et al.*, 2009). It is old an essential winter crop in mountain regions of Nepal. In mountain region, large amount of diversity existed and possible to be the center of diversity of barley (Witcombe & Gilani, 1979). It is the fifth crop after rice, maize, wheat and fingermillet in Nepal. It is the staple food mainly in the hills and high land regions in the western part of the country where farming system is carried out on steep slopes, terraces and river basins of small valleys. In Nepal, during 2016/17 it was cultivated in the total area of 27,370 ha and total production was 30,510 t with productivity of 1,115 kg/ha (MoALD 2017). It is one of the nutritious crops which contain 11.5% protein, 77.4% carbohydrate, 1.3% fat, 3.9% fibre and 1.5% ash (NARC, 2018). It provides nutritional and food security under the harsh environmental conditions in high-hills of Nepal (Baniya, 1989). It is an important crop in these regions because it is grown during winter season and mature approximately one month earlier than wheat which can allow to grow next crops in time. A reported that farmers of Rasuwa preferred to grow barley because it can withstand in less moisture, cold and short duration crop. The area and production of barley is declining every year in terai and stagnant in hill and mountains. It is grown under marginal land by marginalized farmers.

Data showed that area and production is largely decreased in tarai and stagnant in hills and mountains. It could be the lack of high yielding and disease resistant improved varieties, poor crop management practices, cultivation in marginal land, degradation of soil fertility, no access to irrigation, low priority by farmers, researchers and extension workers, low seed replacement rate, changing food habit of local people, lack of nutritional knowledge etc. However it has great potentiality in drought prone areas and agro-based industries to manufacture beverages, noodles, bakery, baby foods and other non-alcohol drinks. It has significant role in food and nutritional security. It is important to evaluate and recommend the best-performing varieties at the major potential areas of Dolakha, Nepal in order to boost production and productivity of barley. The objective of this study was was to identify the best performing genotypes for mid hill condition of Nepal.

MATERIALS AND METHODS

Description of the experimental site

The experiments was conducted at Hill crops research program baiteshwor-4, Kabre, Dolakha of Nepal during winter season for two consecutive years 2017 and 2018.Agro climatically ,this location represents mid hill region of Nepal of country and characterized by warm temperate climate with moderate rainfall. The experimental sites have $86^0$9’ E longitude, $27^0$38’N latitude and 1740 m altitude. The soil is sandy loam and pH ranged from 4.5-6.2 i.e slightly acidic, nitrogen, extractable magnesium and available boron and organic carbon is very low. (NARC, 2018).

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Experimental design, planting materials, and field management

The seeds of all genotypes evaluated in initial evaluation trial (IETs), coordinated varietal trials (CVTs) and farmer's field trials (FFTs) were derived from Hill Crops Research Program, Kabre, Dolakha, Nepal. Barley genotypes were evaluated at Hill Crops Research Program (HCRP), Dolakha during winter seasons for two consecutive years 2017 and 2018. National observation nursery (NON) was laid out in augmented design with plot size of $1m^2$. Similarly initial evaluation trial (IETs), coordinated varietal trials (CVTs) and farmer's field trials (FFTs) were conducted in randomized complete block design (RCBD) with three replications in plot size of $4m^2$, $6m^2$ and $6m^2$ respectively. It was composed of seven genotypes including standard check Solu Uwa and local check. Spacing, fertilizer dose, source of nutrients and method of application and seed sowing method were same to all trials. Standard check Solu Uwa and local checks were planted. Local checks were varied based on locations. Chemical fertilizers was applied @ 30:30:30 NPK kg/ha and source of Nitrogen, Phosphorus and Potash was Urea, Di-ammonium phosphate (DAP) and Murat of Potash (MoP) respectively. Full dose of Phosphorus, Potash and half dose of Nitrogen was applied during final land preparation Remaining half dose of Nitrogen was applied during tillering stage. Seed rate was used @ 100 kg/ha. Rows were spaced at 25cm apart and continuous seeding was done in to the rows.

Data collection and statistical analysis

Data were recorded of plant height (cm), days to 50% days to heading, 75% days to maturity, number of hills per m^2, 1000 grain weight (g), moisture (%,) grain yield t/ha and straw yield t/ha (HCRP, 2018/19). The genotypes were evaluated based on measurement of grain yield. The grain yield was calculated using below formula (MoALD, 2016/17)

$$\text{Grain yield } \left(\frac{\text{t}}{\text{ha}}\right) = \frac{(100 - \text{M}) \times \text{Plot yield (kg)} \times 10000\ (\text{m}^2)}{(100 - 12) \times \text{Net plot area } (\text{m}^2)}$$

Where, M is the moisture content in percentage of the grains.
The analysis of variance was performed using RCBD design to derive variance components derived using the software packages META-R developed by CIMMYT, Mexico (Pacheco *et al.,* 2015). The treatment means were compared by the Least Significant Difference (LSD) test at 5% level (Gomez & Gomez, 1984; Baral et al., 2016; Shrestha, 2019; Jan et al., 2009; Sharma et al., 2016; Kandel & Shrestha, 2019).

RESULTS

National observation nursery – Mountain (NON-M)

In NON, selected genotypes were B86023-1K2-OK3 (6.16 t/ha), Xveola-28/MATICO"S"10 (4.41 t/ha), ACC#2079 (4.41 t/ha),KB-105969-3-2-2K(4.32 t/ha), B86023-1K3-2K-OK3(4.3

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t/ha), LVIRING (S1121-1K) (4.18 t/ha) and ICB88-0160-1K-3K-OK (4.14 t/ha) gave higher grain yield (GY), over to Farmer's variety (3.57 t/ha) (Table 1,2 & 3)

National observation nursery –Early (NON-E)

NON-Early genotypes Acc#2013(3.51 t/ha), GHV06819 (3.47 t/ha), Acc#6316(3.41 t/ha), B86146-1-2-OK (3.21 t/ha) gave higher grain yield (Table 4).

Initial evaluation trials (IET)

Likewise results of combined analysis over years of IETs revealed that, genotypes LG-51/Xveola-2-77-0-3-1-1-OK (2.12 t/ha) and B86099-2-1-OK (2.06 t/ha) produced more GY over to std. check Solu Uwa (1.85 t/ha) and Farmer's variety(1.95 t/ha) (Table 7) . Whereas genotypes INBON P #3 (3.42 t/ha), GR-24-42 (3.15 t/ha), B86099-2-1-OK (3.17 t/ha) during 2017 and genotypes B90K-0114-0-0K (1.25 t/ha), ACC#2470 (1.25 t/ha), LG-51/Xveola-2-77-0-3-1-1-0K (1.16 t/ha) during 2019 were gave higher grain yield (Table 5 and Table 6).

Coordinator varietal trials (CVT)

Similarly results of combined analysis over years of CVT showed that, genotypes, B90K-007-0-2-2-0-OK(2.14 t/ha), ICB90-0196-OAP-2K-OK (1.97 t/ha), B86152-2-3-0-OK (1.97 t/ha) and ICB90-0203-OAP-2K-OK (1.90 t/ha) produced more GY over to std. check Solu Uwa (1.12 t/ha) and Farmer's variety(1.66 t/ha) (Table 10). Whereas genotypes B86099-1K-2K-OK (3.17t/ha), ICBB88-0160-1K-4K-OK (3.06 t/ha), ICB90-096-OAP-2K-OK (2.94 t/ha) and genotypes Coll#112-14 (3.62 t/ha), ICB90-0203-0OAP-2K-0K (1.72 t/ha), NB-HCRP-101 (1.62 t/ha) were gave highest grain yield during 2017 and 2018 respectively (Table 8 and Table 9).

Farmer's Field trials (FFT)

In farmer's field trials (FFT) high yielded genotypes NB-1003-37/903 (2.23 t/ha) and Xveola-45 (2.04 t/ha) produced GY at par to std. check Soluuwa (1.58 t/ha) and Farmer's variety(1.85 kg/ha) in 2017 (Table 11) whereas genotypes LG51/Xveola-2-77 (3.24 t/ha), CENTINELLA/MOY (2.69 t/ha), Muktinath (Coll#112-14 (2.64 t/ha)) gave higher GY but at par to std. check Solu Uwa (1.42 t/ha) and Farmer's variety (1.78 t/ha) in 2018 (Table 12).Thus promising genotypes muktinath (Coll#112-14) and released variety Solu Uwa is best for cultivation for mountain region of Nepal.

DISCUSSION

The mean grain yield of barley genotypes differed across environments which could be due to different environmental conditions over years and location. The location themselves differ greatly in temperature, humidity and rainfall variation that affects yield and yield attributing traits of crop (Kole *et al.*, 2015; Lobell *et al.,* 2011). According to Olesen *et al.* (2000) and Wheeler *et al.* (2000), factors like weather and soils are important causes for crop yield variability. There were great differences between varieties in grain yield. The findings of the study showed that on basis of average across year and each location. The significant variation

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in grain yield due to variation in yield and yield attributing traits of barley. High level of phenotypic variation can be observed in barley genotypes due to significant variation in yield attributing traits such as days to 50% heading, days to maturity, plant height and number of hill and thousand grain weights. Similar finding about high genetic variation in barley reported by was report by Bajracharya *et al.* (2001). In Jumla condition ,local chauli jau showed the better performance over to improved genotypes .Thus it need to be imposed through pure line selection and registered for Jumla valley and similar environment condition. Thus similar finding on lot of variation was observed among the Jumla collections of Nepalese barley for many yield attributing characters (Gupta *et al.*, 2009). Many of these landraces possess one or more characteristics for abiotic and biotic stress tolerance (Upreti, 2005). Therefore, evaluation of Nepalese barley accessions for different agro-morphological traits is very important for crop improvement of barley.

CONCLUSION

The present study was aimed at analyzing the variability present among the barley using agro-morphological traits. The genotypes namely NB-1003-37/903 and Xveola-45, LG51/Xveola-2-77 and Muktinath (Coll#112-14) produced higher grain yield at par to std. check variety Solu Uwa at farmers fields. Local chauli barley showed the better performance over to improved genotypes. Therefore these promising genotypes such as muktinath (Coll#112-14),Xveola-45 and LG51/Xveola-2-77 should be released/registered for Dolakha and similar environment condition and recommended for farmer's cultivation.

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Author's contribution

M. Kandel was the lead investigator and the initiator of the study. N. B. Dhami was responsible for literature search, data generation and drafting of the manuscript. J. Shrestha was responsible for data analysis and drafting of the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding publication of this

REFERENCES

Akar, T., Franci, E., Tondelli, A., Rizza, F., Stanca, A.M., & Pecchioni, N. (2009). Marker-assisted characterization of frost tolerance in barley (*Hordeum vulgare* L.). *Plant Breeding, 128*(4), 381-386.

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ISSN: 2661-6270 (Print), ISSN: 2661-6289 (Online)
DOI: https://doi.org/10.3126/janr.v2i1.26098

Bajracharya, J., Tiwari, P.R., Shakya, D.M., Baniya, B.K., & Sthapit, B.R. (2001). Genetic variation in barley landraces (*Hordeum vulgare* L.), of Jumla ecosite revealed by isozyme analysis. In: Sthapit, B.R., Subedi, A., Upadhaya M.P., & Baniya, B. K. (eds.), Proceedings of a National Workshop on Strengthening the Scientific Basis of In Situ Conservation of Agricultural Biodiversity. 24-26 April 2001, Lumle, Nepal.

Baniya, B.K. (1989). Present Status of Barley Improvement in Nepal. *In a Workshop/Training on Barley February* (Vol.24).

Baral, B. R., Adhikari, P., & Shrestha, J. (2016). Productivity and economics of hybrid Maize (*Zea mays* L.) in the inner terai region of Nepal. *Journal of AgriSearch*, *3*(1), 13–16. https://doi.org/10.21921/jas.v3i1.11401

Gomez, K, & Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. 2nd edition. John Wiley and Sons Inc, New York, USA. 680 p.

Gupta, S.R., Upadhyay, M.P., & Shah, U.S. (2009). Agro-morphological Variability Study of Barley (*Hordeum vulgare* L.) landraces in Jumla, Nepal. *Nepal Agriculture Research Journal*, *9*, 1-11.

Jan, M. T., Shah, P., Hollington, P. A., Khan, M. J., & Sohail, Q. (2009). Agriculture research: Design and analysis. A monograph. Peshawar Agricultural University

Kandel, M., & Shrestha J. (2019). Genotype x environment interaction and stability for grain yield and yield attributing traits of buckwheat (*Fagopyrum tataricum* Geartn). *Syrian Journal of Agricultural Research*, *6*(3), 466-476.

Kole, C., Muthamilarasan, M., Henry, R., Edwards, D., & Sharma, R. (2015). Application of genomics assisted breeding for generation of climate resilient crops: Progress and prospects. *Frontiers in Plant Science*, *6*, 563.

Lobell, D.B., Schlenker, W., & Roberts, J. costa. (2011).Climate trends and global crop production since 1980. *Science*, 333, 616-20.

MoALD. (2017). Statistical Information on Nepalese Agriculture 2016/2017. Government of Nepal, Ministry of Agriculture Development. Agri Business Promotion and Statistics Division. Singh Durbar, Kathmandu, Nepal.

NARC. (2018). Annual Report (2017/18) of Nepal Agricultural Research Council (NARC), Hill Crops Research Program, Kabre, Dolakha, Nepal

Ones, J.M., & Singh, M. (2000). Time trends in crop yields in long-term trails. *Experimental Agriculture*, *36*, 165-179.

Pacheco, A., Vargas, M., Alvarado, G., Rodríguez, F., López, M., Crossa J., & Burgueño, J.(2015). User's Manual GEA-R (Genotype by Environment Analysis with R). "GEA-R (Genotype x Environment Analysis with R for Windows) Version 4.1", hdl:11529/10203, CIMMYT Research Data & Software Repository Network, V16.

Sharma, H. P., Dhakal, K. H., Kharel, R. & Shrestha, J. (2016). Estimation of heterosis in yield and yield attributing traits in single cross hybrids of maize. *Journal of Maize Research and Development*, 2(1), 123-132.

Shrestha, J. (2019). P-Value: A true test of significance in agricultural research. Retrieved from *https://www.linkedin.com/pulse/p-value-test-significance-agricultural-research-jiban-shrestha/*

Journal of Agriculture and Natural Resources (2019) 2(1): 322-337
ISSN: 2661-6270 (Print), ISSN: 2661-6289 (Online)
DOI: https://doi.org/10.3126/janr.v2i1.26098

Upreti, R.P. (2005).Status of food barley in Nepal.p.99-114. In Grando, S., & Macpherson, H. G. (eds.) Food barley: Importance, use and local knowledge. Proceeding of internal workshop on food Barley Improvement,14-17 January 2002, Hammamet,Tunisia.

Wheeler, T.R., Craufurd, P.Q., Ellis, R.H., Porter, J.R., & Vara Prasad, PV. (2000). Temperature variability and the yield of annual crops. *Agriculture, Ecosystems and Environment*, *82*, 159-167.

Witcombe, J.R., & Gilani, M.M. (1979). Variation in cereals from the Himalays and the optimum strategy of sampling germplasm. *Journal of Applied Ecology,* 633-640.

Journal of Agriculture and Natural Resources (2019) 2(1): 322-337
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Table 1. Performance of Barley genotypes evaluated in NON-Mountain at HCRP, Dolakha in 2017.

SN	Name of Genotype	50% DTH	75% DTM	PH (cm)	SL (cm)	LS (1-5)	GY (t/ha)
1	ICB-105969-3-2-2K	114	164	100	7.5	4	6.9
2	Xveola-28/VIRING“S”12K-1K	104	164	105	7.3	3	5.32
3	GR-24-42	96	160	86	9.4	3	4.92
4	Xveola-28/MATICO“S”	104	162	103	10.2	2	4.58
5	ACC#5177	100	103	96	7.7	4	4.34
6	B90K-014-1-1-1-0-OK	117	163	108	8.1	5	4.3
7	B86019-1K-3K-OK	104	163	94	7.3	5	4
8	ICB88-0160-1K-3K-OK	104	162	110	5.7	2	3.96
9	B86023-1K3-2K-OK3	95	164	105	6.1	4	3.94
10	ACC#2079	110	163	99	8.9	2	3.9
11	Coll#112-14	110	102	98	8.7	3	3.76
12	Farmer’s variety	105	163	93	8.8	4	3.74
Grand Mean		105	152	100	7.97	4	4.47

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, SL= Spike length,LS= Lodging,GY=Grain yield

Table 2. Performance of Barley genotypes evaluated in NON-Mountain at HCRP,Dolakha in 2018.

SN	Genotypes	50% DTH	75%DTM	PH(cm)	SL(cm)	GY(t/ha)
1	B86023-1K2-OK3	92	152	103	8	9.15
2	KB-105969-3-2-2k	116	163	104	9	1.73
3	Xveola-28LVIRING(S1121-1K)	104	166	91	10	3.04
4	GR-24-42	94	156	80	8	2.41
5	Acc#2079	117	157	88	9	4.91
6	B86023-1K3-2K-OK3	94	154	110	8	4.65
7	local uwa check	115	163	114	7	4.58
8	Xveola-28/MAIICOS'10	94	153	99	9	4.24
9	Farmer’s variety	102	156	124	9	4.46
Grand Mean		103	157	101	8	4.35

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, SL= Spike length,GY=Grain yield

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Table 3. Combined Performance of Barley genotypes evaluated in NON-M ountain at HCRP,Dolakha in 2017 and 2018.

SN	Genotypes	50%DTH	75% DTM	PH(cm)	SL(cm)	GY(t/ha)
1	B86023-1K2-OK3	94	158	97	8	6.16
2	Xveola-28/MAIICOS'10	99	158	101	10	4.41
3	Acc#2079	114	160	94	9	4.41
4	KB-105969-3-2-2k	115	164	102	8	4.32
5	B86023-1K3-2K-OK3	95	159	108	7	4.3
6	Xveola-28LVIRING(S1121-1K)	104	165	98	9	4.18
7	ICB88-0160-1K-3k-OK	110	163	115	7	4.14
8	Muktinath (Coll# 112-14)	113	135	96	10	4.05
9	B9Ok-014-1-1-1-0-OK	110	161	107	8	3.73
10	GR-24-42	95	158	83	9	3.67
11	ICBON-06-OAP-2K-OK	107	162	86	8	3.66
12	B860191K-3K-OK	98	158	89	7	3.63
13	Farmer's variety	109	161	124	8	3.57
	Grand Mean	102	160	100	8	3.04
	Genotype significance	0	0.77	0	0.32	0.09
	CV(%)	5.83	5.37	10.52	14.12	33.8
	LSD(0.05)	11.91	17.14	21.09	2.23	2.05

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, SL= Spike length,GY=Grain yield

Table 4. Combined performance of Barley genotypes evaluated in NON-Early mountain at HCRP, Dolakha in 2017 and 2018.

SN	Genotype	50%DTH	75% DTM	PH(cm)	NH/m^2	SL(cm)	GY(t/ha)
1	Acc#2456	100	151	108	148	8	1.72
2	Acc#2013	100	155	104	353	8	3.51
3	Acc#1555	98	156	114	172	7	2.84
4	Acc#1607	99	156	91	159	7	3.15
5	Acc#1603	96	156	107	176	6	2.40
6	B86146-1-2-OK	98	156	103	177	7	3.21
7	Acc#1614	111	157	100	171	7	2.52
8	Acc#2494	93	157	103	162	8	2.44
9	Acc#6316	111	157	100	259	7	3.41
10	BN-HONA	113	157	100	218	8	3.19
11	Acc#2033	104	157	95	183	6	2.46
12	GHV06820	106	157	114	160	6	2.90
13	Acc#2526	106	158	96	180	5	2.30
14	Acc#2474	106	158	104	117	8	2.97
15	Acc#GHV06819	105	158	114	106	6	3.47
16	Acc#2446	102	158	157	196	8	2.97
17	GHV06816	110	158	103	123	6	2.24

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18	Farmer's variety	101	159	102	138	7	2.84
19	Solu Uwa (Std. check variety)	102	161	95	166	5	2.80
	Grand Mean	106	160	103	171	7	2.67
	P value	0.14	0.35	0.23	0.04	0.22	0.24
	CV(%)	8.33	2.90	11.77	28.34	16.92	29.96
	LSD(0.05)	17.82	9.37	24.52	97.89	2.33	1.62

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, SL= Spike length,NH= Number of head GY=Grain yield

Table 5. Performance of Barley genotypes evaluated in IET-Mountain at HCRP,Dolakha in 2017.

SN	Name of Genotypes	50% DTF	75% DTM	PH (cm)	NS /m^2	NR /Spike	TN /m^2	SL(cm)	GY (t/ha)
1	INBON P #3	102	160.3	90.7	120	6.0	281	8.0	3.42
2	B90k-004-1-2-2-2-2-OK	111	164	95.5	188	2.0	541	8.7	2.99
3	B90k-014-0-OK	110	164	94.5	168	2.0	483	9.0	2.64
4	ICB90-0292-OAP	95.0	156	89.4	93.0	6.0	214	7.3	2.56
5	B90k-022-06-2-0-OK	94.0	150	63.9	113	6.0	254	9.0	3.03
6	MARCO SLOY -IB-OY	113	164	90.6	167	2.0	409	8.7	2.54
7	LG-51/Xveola -2-77-0-3-1-1-OK	97.0	158	82.8	122	6.0	300	6.7	3.08
8	B90K-024-1-2-1-OK	103	160	85.2	105	6.0	267	9.3	1.69
9	INBON#62	98.0	159	93.6	89.0	6.0	232	8.3	1.74
10	B86099-2-1-OK	101	160	85.8	111	6.0	288	7.0	3.17
11	CENTINELLA/OY	106	164	82.7	117	6.0	277	9.0	2.52
12	INBON#17	98.0	159	73.5	112	6.0	216	8.7	2.31
13	GR-24-42	111	160	103	96.0	6.0	302	6.0	3.15
14	B86160-1-1-0-OK	103	156	98.9	142	6.0	354	7.0	2.29
15	Soluuwa (Std. check variety)	110	164	81.0	109	6.0	207	9.3	2.65
16	Local check	98.0	164	94.1	104	6.0	281	7.0	2.88
Grand mean		103	160	88.0	122.1	5.2	307	8.06	2.67
CV%		8.3	4.7	11.5	18.9	-	24.6	9.8	19.7
P value		0.107	0.641	0.008	0.001	-	0.001	0.001	0.012
LSD (0.05)		-	-	32.2	73.54	-	240	2.52	1.67

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height,NS= Number of spike TN= Tillers Number, NR= Row number, GY=Grain yield

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Table 6. Performance of Barley genotypes evaluated in IET-Mountain at HCRP,Dolakha in 2018.

SN	Genotype	50%DTH	75%DTM	PH	NS/m^2	TN/m^2	SL(cm)	TGW(g)	GY(t/ha)
1	B90K-011-1-1-1-0K	94	147	121	192	217	7	39	1.07
2	GCORIA"S"/OY-IB-0Y	113	161	88	177	213	9	48	0.52
3	B90K-0114-0-0K	104	159	109	252	266	8	35	1.25
4	ICB90-0292-OAP	103	158	87	146	162	8	38	0.72
5	B90K-022-06-2-1-0-0K	96	150	120	230	239	7	38	0.82
6	MARCO"S"/OY-IB-OY	97	152	105	154	162	7	36	0.84
7	LG-51/Xveola-2-77-0-3-1-1-0K	98	155	127	205	224	8	35	1.16
8	B90K-024-1-2-1-1-0K	99	152	101	172	239	10	53	0.58
9	INBON#62	100	156	104	171	176	8	46	0.92
10	B86099-2-1-0K	103	150	115	263	272	7	38	0.94
11	Centinella/MOY	100	158	102	171	185	8	35	1.07
12	ACC#5177	96	149	106	236	246	6	28	0.84
13	GR-24-42	104	157	92	203	218	9	38	0.94
14	ACC#2470	96	155	115	293	261	8	33	1.25
15	Solu Uwa (Std. check)	96	143	95	219	235	6	28	1.05
16	Farmer's variety	105	156	117	149	182	8	34	1.02
	Grand Mean	100	153	107	202	218	8	38	0.94
	P value	0.00	0.00	0.00	0.59	0.84	0.06	0.00	0.00
	CV(%)	2.41	1.76	1.52	32.43	30.24	12.57	7.13	15.34
	LSD(0.05)	5.15	5.75	3.46	139.49	140.70	2.04	2.86	0.31

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, NR= Row number, TGW= Thousand Grain Weight, GY=Grain yield

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Table 7. Combined Performance of Barley genotypes evaluated in IET-Mountain at HCRP,Dolakha in 2017 and 2018

SN	Genotype	50%DTH	75% DTM	PH(cm)	NS/m^2	TN/m^2	GY(t/ha)
1	B90K-0114-0-0K	103	160	102	210	375	1.95
2	ICB90-0292-OAP	99	157	88	120	188	1.64
3	B90K-022-06-2-1-0-0K	95	150	92	172	247	1.93
4	MARCO"S"/OY-IB-OY	105	158	98	161	286	1.69
5	LG-51/Xveola-2-77-0-3-1-1-0K	98	157	105	164	262	2.12
6	B90K-024-1-2-1-1-0K	101	156	93	139	253	1.14
7	INBON#62	99	158	99	130	204	1.33
8	B86099-2-1-0K	102	155	101	187	280	2.06
9	Centinella/MOY	103	161	92	144	231	1.80
10	GR-24-42	101	158	97	150	260	2.05
11	Solu Uwa(Std. check)	103	154	88	164	221	1.85
12	Farmer's variety	102	160	106	127	232	1.95
	Grand Mean	101	157	97	155	253	1.79
	P value	0.86	0.56	0.92	0.24	0.28	0.17
	CV(%)	5.44	2.85	13.43	19.22	22.48	17.61
	LSD(0.05)	12.07	9.86	28.58	65.74	125.25	0.69

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, GY=Grain yield

Table 8. Performance of Barley genotypes evaluated in CVT-Mountain at HCRP,Dolakha in 2017.

SN	**Name of Genotype**	**50%DTF**	**75%DTM**	**PH (cm)**	**SN /m^2**	**SL (cm)**	**TN /m^2**	**TGW (g)**	**GY (t/ha)**
1	ARUPOS/OY-B-OY	96	160	86.1	75.0	7.7	380	54.8	1.62
2	ICB90-096-OAP-2K-OK	102	130	87.1	88.0	7.4	226	39.55	2.94
3	B86038-1K-2K-OK3	110	165	87.5	89.0	7.5	271	37.48	1.65
4	LG51/Xveola-2-77	98	157	90.5	95.0	7.7	285	42.04	2.90
5	B86152-2-3-0-OK	103	161	85.1	102	8.1	205	35.86	2.50
6	ICB90-0203-OAP-2K-OK	102	161	88.8	103	7.9	286	54.83	2.08
7	CENTINELLA/MOY	102	161	86.3	114	8.0	166	40.37	2.00
8	ICBB88-0160-1K-4K-OK	101	162	92.5	120	8.0	214	39.44	3.06
9	B90K-007-0-2-2-0-OK	104	163	68.1	121	6.9	268	35.76	2.78
10	B86099-1K-2K-OK	104	162	88.8	124	7.2	261	40.27	3.17
11	NB-HCRP-101	99.0	152	87.0	130	7.7	162	50.37	0.661
12	NB-HCRP-102	112	163	83.6	136	8.1	328	40.95	1.07
13	NB-HCRP-103	115	164	82.8	139	8.9	227	46.03	0.616
14	NB-HCRP-104	116	162	86.6	140	7.7	212	48.22	1.18
15	Farmer's variety	104	168	95.7	142	7.3	219	41.14	2.18
16	Solu Uwa(Std. check variety)	96.0	179	86.3	162	7.7	141	34.59	1.75
Grand mean		104	161	86.4	117.5	7.7	241	42.61	2.01
CV%		4.5	9.3	11.9	26.5	13.7	29.4	6.2	37.9
P value		0.001	0.252	0.51	0.09	0.893	0.022	0.001	0.001
LSD (0.05)		14.77	-	-	-	-	225.1	8.399	2.42

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, NR= Row number, TGW= Thousand Grain Weight, GY=Grain yield

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Table 9. Performance of Barley genotypes evaluated in CVT-Mountain at HCRP,Dolakha in 2018.

SN	Genotypes	50% DTH	75% DTM	PH(cm)	NS/m^2	SL(cm)	TN/m^2	TGW	GY(t/ha)
1	INBON P#3	104	171	61	130	7.9	160	59	1.45
2	NB-HCRP-102	96	168	98	121	6.7	131	53	0.59
3	NB-HCRP-103	104	162	93	191	8.5	203	55	0.96
4	NB-HCRP-104	100	160	109	219	8.5	259	39	1.17
5	B90K-004-0-1-2-2-2-OK	105	164	112	200	7.9	231	37	0.98
6	B86160-1-1-0-0K	103	165	113	282	8.1	309	53	1.44
7	B90K-007-0-2-2-0-0K	112	171	104	163	7.6	209	37	1.50
8	Solu Uwa(Std. check variety)	98	168	99	150	8.0	166	56	0.48
9	Farmer's variety	118	170	86	131	7.7	147	47	1.13
10	INBON P#17	118	170	92	112	9.0	114	51	0.84
11	ARUPOS/OY-B-OY	115	169	91	133	8.2	180	52	0.17
12	ICB90-0196-OAP-2K-OK	103	164	134	139	7.6	168	42	1.00
13	B86152-2-3-0-OK	118	166	114	186	8.9	206	37	1.44
14	ICB90-0203-0OAP-2K-0K	94	156	99	188	7.7	206	39	1.72
15	Muktinath(Coll#112-14)	96	156	88	154	6.6	177	29	3.62
16	NB-HCRP-101	114	164	121	194	6.6	175	45	1.62
	Grand Mean	106	165	101	168	7.9	190	46	1.26
	P value	0.00	0.00	0.02	0.10	0.03	0.01	0.00	0.01
	CV(%)	6.07	2.41	18.29	34.79	10.76	26.71	4.32	65.97
	LSD(0.05)	10.75	6.63	30.76	97.68	1.41	84.71	1.64	1.38

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, TGW= Thousand Grain Weight, GY=Grain yield

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Table 10. Combined Performance of Barley genotypes evaluated in CVT-Mountain at HCRP,Dolakha in 2018.

SN	Genotypes	50%DTH	75%DTM	PH(cm)	NS/m^2	SL(cm)	TN/m^2	TGW	GY(t/ha)
1	NB-HCRP-102	104	166	91	129	7	230	34	0.83
2	NB-HCRP-103	110	163	88	165	9	215	37	0.81
3	NB-HCRP-104	108	161	98	180	8	236	34	1.18
4	B90K-007-0-2-2-0-0K	108	167	86	142	7	239	27	2.14
5	Solu Uwa(Std. check vareity)	97	174	93	156	8	154	31	1.12
6	Farmer's variety	111	169	91	137	8	183	32	1.66
7	ARUPOS/OY-B-OY	106	165	89	104	8	280	40	0.90
8	ICB90-0196-OAP-2K-OK	103	147	111	114	8	197	30	1.97
9	B86152-2-3-0-OK	111	164	100	144	9	206	27	1.97
10	ICB90-0203-OAP-2K-0K	98	159	94	146	8	246	37	1.90
11	NB-HCRP-101	107	158	104	162	7	169	36	1.12
	Grand Mean	106	163	95	143	8	214	33	1.42
	P value	0.84	0.31	0.60	0.32	0.19	0.63	0.48	0.30
	CV(%)	8.80	5.10	12.18	19.02	6.82	27.20	17.38	43.45
	LSD(0.05)	20.69	18.49	25.72	60.73	1.18	129.59	12.91	1.37

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, TGW= Thousand Grain Weight, GY=Grain yield

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Table 11. Performance of Barley genotypes evaluated in FFT-Mountain at HCRP,Dolakha in 2017.

SN	Name of Genotype	50% DTH	75% DTM	PH (cm)	NS /m^2	RN /Head	TN /m^2	TGW (g)	GY (t/ha)
1	NB-1003-37/1034	102	162	71.9	167	6.0	230	40.83	1.72
2	Xveola -45	109	164	88.1	153	6.0	261	40.7	2.04
3	NB-1003-37/903	110	165	78.3	155	6.0	226	42.61	2.23
4	Xveola -38	106	163	82.1	118	6.0	215	38.62	1.27
5	Soluuwa (Std. check variety)	90.0	157	73.5	78.0	6.0	179	36.73	1.58
6	Farmer's variety	85.7	158	75.3	117	6.0	224	37.25	1.85
7	Xveola -2	93.3	160	87.1	192	6.0	309	40.48	1.77
	Grand mean	99.5	161	79.5	140	6.0	235	39.60	1.78
	CV%	10.4	1.2	8.6	30.5	-	22.6	4.1	15.9
	P value	0.070	0.001	0.070	0.095	-	0.190	0.008	0.028
	LSD (0.05)	-	7.406	-	-	-	-	6.298	1.09

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike, RN= Row number, TN= Tillers Number, SL= Spike length, TGW= Thousand Grain Weight, GY=Grain yield

Table 12. Performance of Barley genotypes evaluated in FFT-Mountain at HCRP,Dolakha in 2018.

SN	Genotypes	50% DTH	75%DTM	PH (cm)	NS/m^2	TN/m^2	SL(cm)	GY (t/ha)
1	Xveola-45	109	167	95	151	191	7	2.18
2	Muktinath(Coll#112-14)	109	167	96	143	178	9	2.64
3	Solu Uwa(std check)	88	146	84	134	148	7	1.42
4	Local jau/Uwa	95	164	104	124	144	6	1.78
5	CENTINELLA/MOY	96	159	90	127	165	8	2.69
6	ICB88-0160-1K-4K-0K	100	159	92	134	149	7	2.58
7	LG51/Xveola-2-77	94	149	100	106	133	8	3.24
	Grand Mean	99	159	94	131	158	7	2.36
	P value	0.00	0.00	0.18	0.85	0.45	0.00	0.11
	CV (%)	5.18	1.01	8.78	29.35	22.13	5.93	29.98
	LSD (0.05)	9.10	2.84	0	0	0	1.51	0

Note: DTH= Days to heading, DTM= Days to maturity, PH= plant height, NS= Number of spike TN= Tillers Number, SL= Spike length, GY=Grain yield

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Table: Mean climate data of the experimental site (2017 and 2018)

Month	Maximum Temp (^{0}C)	Minimum Temp (^{0}C)	Total Rainfall (mm)
January	18.15	6.75	22.6
February	22.15	9	54
March	22.75	11.15	49
April	25.75	13.75	86.3
May	26.75	14.65	234.65
June	27.4	18	383.15
July	26.5	18.75	524.8
August	27.25	18.5	428.25
September	27.75	17.85	238.2
October	27.55	11.9	56
November	23.45	9.55	0
December	20.95	8	0